

# Does the “Project Manager” still exist in Agile Software Development Projects?

Yogeshwar Shastri, Rashina Hoda

Department of Electrical and Computer Engineering  
The University of Auckland  
Auckland, New Zealand  
ysha962@aucklanduni.ac.nz, r.hoda@auckland.ac.nz

Robert Amor

Department of Computer Science  
The University of Auckland  
Auckland, New Zealand  
trebor@cs.auckland.ac.nz

**Abstract**— The project manager has been a ubiquitous feature of traditional software development projects. However, agile software development (ASD) methods which emphasize self-organizing teams and rapid response to change have done away with the project manager’s title. New job titles such as the scrum master and product owner have been introduced instead. It is unclear as to what extent the “project manager” is still encountered in the agile software industry. An online survey was posted out to agile special interest groups on popular social media platforms to discover the frequency of the job title “project manager” in agile projects. Analysis of the 97 responses from 31 countries around the world revealed that: a) the title of project manager is still widely used (67%); b) there is a correlation between the team size and presence of project manager such that there is a higher probability the project manager will be present in teams of 5-10 members and those over 25 members; and c) there is an inverse correlation between the co-location of a team and presence of project manager. Further research is needed to better understand *why* the project manager continues to be present on ASD projects and *how* their role may have changed.

**Keywords**—agile project management; project manager; agile software development; software project management

## I. INTRODUCTION

One of the most popular traditional software development methodologies followed in the software industry was the Waterfall model – based on a modification by Royce [1] of the original model proposed by Bennington [2] in 1956. It is a specification-driven approach characterized by extensive planning, upfront requirements gathering, detailed documentation and a keen focus on following the process. In software projects following traditional software development methodologies such as the Waterfall model, the project manager plays a central role in the project lifecycle. This includes a comprehensive set of responsibilities such as leadership, team building, motivation, communication, influencing, decision making, planning, and coaching [3],[4].

However since the late 1990s the importance of the role of the project manager has seen a steady erosion; the motivating factor in this case being the introduction of agile software development (ASD) in the software industry [5]. In stark contrast to traditional methods, ASD is an incremental and iterative development method and focuses on rapid response to

changing business requirements, self-organizing teams, and customer collaboration [6]. ASD has completely dispensed with the formal job title of the project manager. Agile methodologies such as scrum seem to distribute the erstwhile responsibilities of the project manager into new roles such as the product owner and the scrum master [7].

It is unclear what fate the job title “project manager” has met in the software industry. Thus, the main question this study aimed to address was: “Does the *project manager* still exist in ASD projects?”

To answer this research question an online survey was carried out. This study is part of a larger project which looks to investigate project management and the role of managers in ASD projects.

The paper is structured as follows: Section II gives a brief background on ASD and on the role of the project manager; Section III covers the research methodology; Section IV presents the results of the online survey and data analysis; and the conclusions and future directions are covered in section V.

## II. BACKGROUND

In the subsections below a brief background of the evolution of ASD and by corollary agile project management (APM) is given. The role of the project manager in traditional software development projects is also touched upon for a better overview of the research question. The terms ASD and agile are used interchangeably throughout the paper.

### A. Agile software development (ASD) and agile project management (APM)

The evolution of agile can be traced back to the formulation of the agile manifesto in early 2001 [25], which laid out the core principles of ASD. Since then, ASD has rapidly emerged as a strong contender to traditional software development methodologies [5]. The key characteristics that differentiate agile from traditional software development methods are its incremental and iterative nature, ability to respond to change, and focus on human and social aspects [25].

Agile can be thought of as an overarching canopy that consists of different software development methods such as crystal [8], dynamic software development method (DSDM) [9], feature-driven development (FDD) [10], scrum [7], and

eXtreme programming (XP) [11]. The most popular agile method used is scrum or a scrum hybrid with other agile implementations [12]. In the latest state-of-agile industry survey nearly 75% of the respondents indicated that their organization used scrum or a scrum hybrid [12]. More importantly, scrum is primarily focused on software project management, while most other agile methods such as XP focus on development activities [13],[14]. Scrum includes a set of unique project management artifacts and meetings such as user stories, the product backlog, daily scrum, sprint review meeting, and sprint planning meeting [15].

The project management aspect of agile (i.e. agile project management (APM)) has been defined in practitioner literature as, “*the work of energizing, empowering, and enabling project teams to rapidly and reliably deliver business value by engaging customers and continuously learning and adapting to their changing needs and environments*” [21,page 23]. One of the main aspects that differentiates APM and traditional project management methods is the balance and distribution of decision making authority between the team and the manager. In APM, teams have high autonomy and are meant to be *self-organizing* i.e. where team members “*enjoy high levels of autonomy, commit to, select, and accomplish their own tasks, to organize themselves*” [17, page 246].

#### B. Who is The Project Manager?

One of the earliest definition of the project manager was envisioned as someone who manages a team of professionals, whose job is finite in duration, who recruits the project team, conducts project planning and is able to “sell” the project to stakeholders [18]. The project management book of knowledge (PMBOK), which is one of the most widely accepted compendiums of project management practices, has defined the project manager as “*the person assigned by the performing organization to lead the team that is responsible for achieving the project objectives*” [3, page 16]. The role and responsibilities of the project manager cover a variety of areas such as leadership, team building, motivation, communication, influencing, decision making, political and cultural awareness, negotiation, trust building, conflict management, planning, effective supervision, budgeting, and coaching [3],[4]. The project manager has also been categorized as a “skilled technician” i.e. a person whose role primarily centers on controlling time, cost and the scope of the project [19].

#### C. The Software Project Manager

In traditional software development methodologies such as the Waterfall model [1], [20], the project manager has considerable control and authority over the project team [5],[22]. The nature of tasks and responsibilities of the *software* project manager are very similar to those specified in project management literature [3],[4]. The Waterfall approach has been held responsible for the development of a centralized hierarchy within the project [16]. This centralized nature of decision making sits uneasily with software development which is characterized by a fluid environment [23].

#### D. Quo Vadis Project Manager ?

In ASD methods such as scrum and XP, the job title of the project manager has been eliminated [24]. Scrum innovated two new roles, namely that of the product owner and the scrum master [7],[24]. The product owner represents the customer and guides the team to work towards the customer’s requirements and is responsible for prioritizing the product features [7], [26]. The scrum master facilitates the team’s functioning and removes obstacles to the delivery of the product [16].

XP has a different set of roles such as the coach, consultant, tracker, programmer, customer, tester, and the big boss [11]. From these roles, the role of the “coach” has some similarities in terms of its responsibilities with the traditional definition of the project manager’s role [1],[11]. The responsibilities of the coach include ownership of the process, providing the team with guidance and learning from other XP teams [11].

Thus as per theory both XP and scrum have done away with the job title of project manager. It was important to empirically investigate whether there was a convergence or a gap between what the theory recommended (i.e. no project manager in ASD) to what exists in practice.

### III. RESEARCH METHODOLOGY

To answer the overarching question “does the project manager exist in ASD projects”, the research instrument used was an online questionnaire survey created using Google forms and posted in special interest groups (SIG) on popular social media platforms such as agile groups on LinkedIn (e.g. agile and lean software development forum, agile coaching forum, agile project management.) The survey form and questions were designed and refined through discussions between all three researchers to be clear to understand and avoid ambiguity. The questionnaire was left open for submissions for seven months and elicited 97 unique responses from software professionals all over the world.

The questionnaire was divided into two sections: a) demographic information and b) project specific information. The latter section was used to gather information relevant to the study’s aim. The questions used to gather the demographic data were:

- Please enter your country of residence.
- What sector is the current project in?
- Please select your age bracket.
- What is your total work experience in the software industry? (in years)
- What would be the approximate number of years you have worked on agile projects?
- What would be the approximate number of years you have worked on traditional projects?

In addition to demographic questions the questions directly linked to the aims of the study included:

- What is your current job title?

- What is the software development method used in your current project?
- What is the number of team members on the project?
- Is there a project manager in your project team?
- If there is no project manager, who is responsible for managing the team?
- Is the project team co-located or is it distributed?

Some questions had a list of responses to select from, for example: age range could be selected from 20-30,30-40,40-50,50-60 and over 60. Others were open-ended questions to allow for a range of answers, for example: the job title was a free text field, keeping in mind the diversity of job titles in the industry. The question used to assess the frequency of the project manager role was “is there a project manager in your team?” – a closed question, whose results are presented in Fig. 8. The following section presents the results of the analysis of the demographic and project specific information.

#### IV. RESULTS

The results of the survey have been presented in two sections: section A deals with the demographic information and section B presents the results of the data analysis. To put the results into perspective, where possible, our results have been compared with those reported by the VersionOne survey [12]. The VersionOne survey is an annual industry wide survey which gathers data on the use of agile. Where corresponding data has been found in the VersionOne report [12] it has been presented in the sub sections below.

##### A. Demographic Information

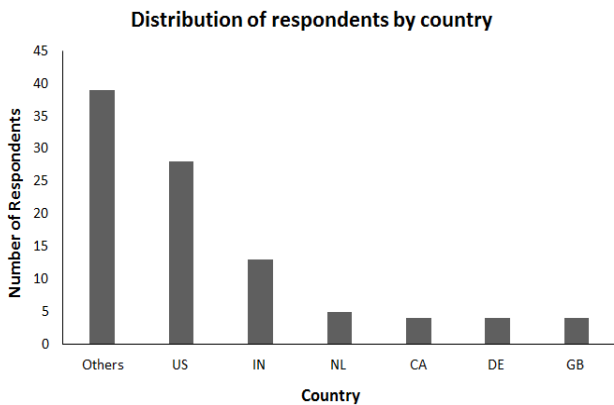


Fig. 1. Distribution of respondents by country (CA=Canada, DE=Germany, GB= United Kingdom, IN=India, NL=Netherlands).

The survey attracted 97 software practitioners from 31 countries across the globe. As shown in Fig.1, the highest number of respondents from a single country, 29% (N=28), were from the USA. India was the next highest contributor with 13% (N=13) of the respondents, which was followed by the Netherlands with 5% (N=5). Canada, Germany and United Kingdom, each accounted for 4% of the respondents. The

countries which had between one to four respondents have been grouped in the category “other” and this grouping had 25 countries which included Sweden, New Zealand, Australia, Russia, Romania and Mexico amongst others.

In terms of the project sector or domain of the participants (see Fig.2), about 17% of respondents were from the finance and banking services sector (N=16). Information technology fielded 15% (N=14), 13% were from healthcare (N=12), 7% from telecommunications (N=7), and 6% (N=6) from software. The remaining 37% of the respondents came from a variety of backgrounds such as retail, entertainment, education etc. They have been grouped into the category of “other” for analysis purposes.

Distribution of respondents by project sector

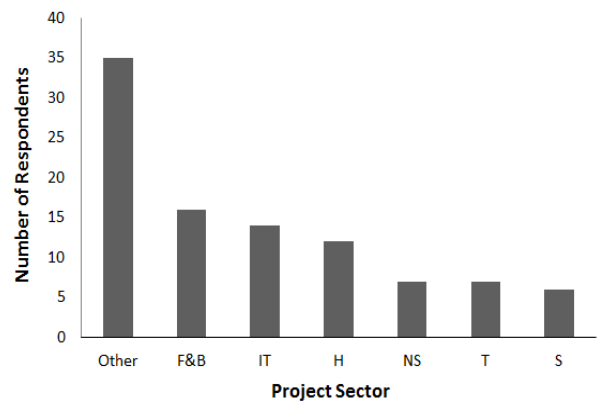


Fig. 2. Distribution of respondents by project sector (F&B=Finance and banking, H=Healthcare, IT=Information Technology, NS=Not Specified, S=Software, T=Telecommunications).

In terms of total work experience (see Fig.3), 44% (N=43) of the respondents had between 10-20 years of total work experience, 33% (N=32) had more than 20, 12% (N=12) had between 5 to 10 years, and 10% (N=10) had less than 5 years of total work experience.



Fig. 3. Total work experience of the respondents.

The data for work experience of participants on agile projects is shown in Fig.4. Around 65% (N=61) of the respondents had less than 5 years’ experience of working on

Agile projects, 29% (N=27) respondents had between 5 to 10 years' experience, 4% (N=4) had between 11 to 15 years' experience, 4% (N=4) had between 16 to 20 years' experience, and 1% (N=1) had over 20 years' experience. This is in line with the fact that in the last ten years the adoption of Agile has rapidly picked up pace. In the latest VersionOne report on the state of agile [12] involving 3880 respondents, nearly 33% of the respondents indicated that they had more than 5 years of experience in agile [12], which is comparable to the same in our smaller sample. This is a jump of nearly 4% over the previous report VersionOne which was released in 2015 [12].

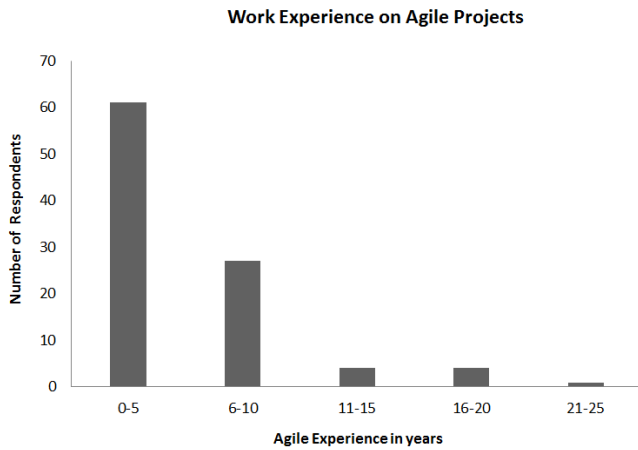


Fig. 4. Work experience of respondents on agile projects.

The work experience data of respondents on traditional projects is shown in Fig. 5. Around 30% (N=71) of the participants had less than 5 years' experience of working on traditional projects, 29% (N=27) had between 6 to 10 years' experience, 26 % ( N=24) had between 11 to 15 years' experience, 11% (N=10) had between 16 to 20 years' experience, 4% (N=4) had between 21 to 25 years' experience and 4% (N=4) had over 25 years' experience. Only 24% of the participants (N=23) had over 25 years' experience of working in traditional software development projects.

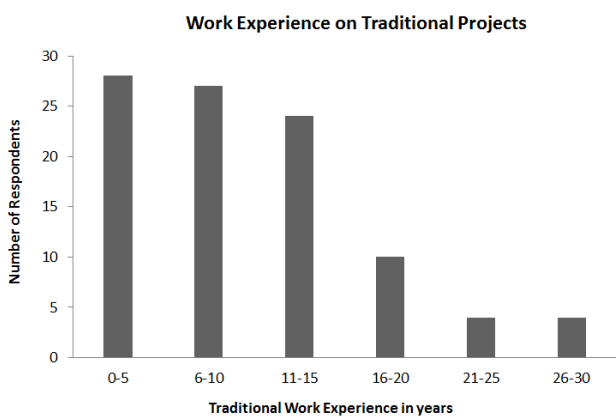


Fig. 5. Work experience of the respondents on traditional projects.

The question on team size yielded interesting data (see Fig.6), which has been analyzed further in sub-section B. A

team size of 5-10 people was most common with 39% (N=36) of the respondents reporting this team size. 23% (N=22) reported a team size of between 10 to 15 members. 15% (N=15) had greater than 25 team members, 13% (N=13) had between 0 to 5 members, 5% (N=5) between 20 to 25 members and 4% (N=4) between 15 to 20 members.

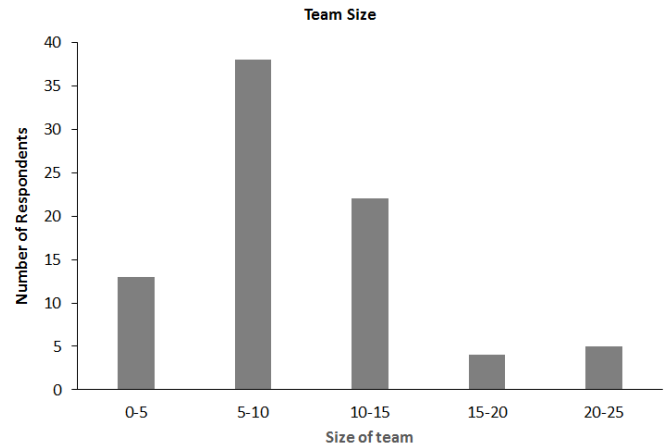


Fig. 6. Frequency of team size.

Around 24% (N=23) of the respondents identified themselves as “project managers” (see Fig.7). This result tallies with the VersionOne report where 24% of respondents were project managers [12]. Around 11% (N=12) were scrum masters, and 4% (N=4) were agile coaches. The remaining 60% (N=58) comprised of a variety of job titles such as chief executive officer (CEO), product owners (PO), quality analysts (QA) etc.

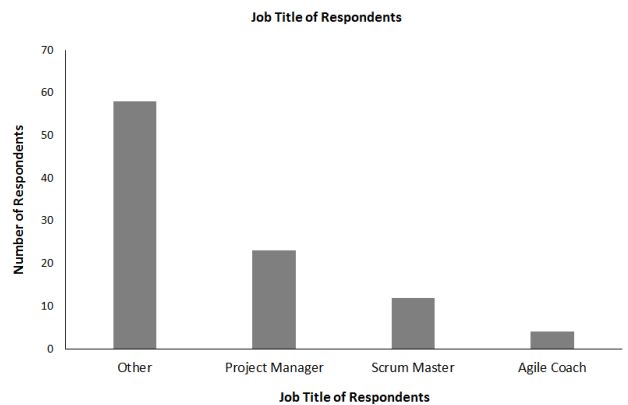


Fig. 7. Job title of respondents.

### B. Project Related Information

This subsection presents information gathered from the survey that was specific to the use of ASD by the respondents. This includes data on the type of agile method used on the respondent's current project, the presence or absence of the job title project manager and the location of the team.

As can be seen in Fig.8, around 67% (N=65) of the respondents indicated that there was a project manager present

on the agile project, while 33% (N=32) indicated that there was no project manager present.

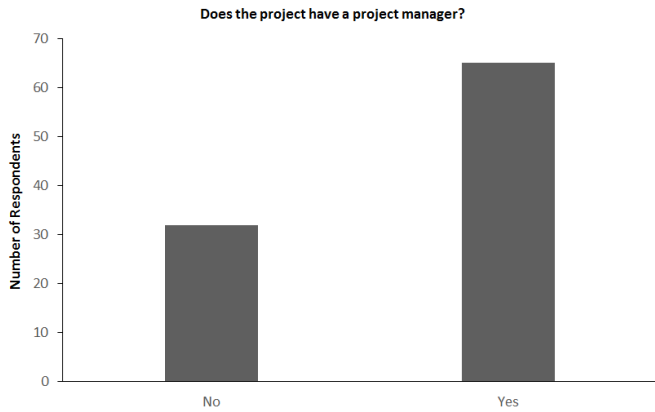


Fig. 8. Does the project have a project manager?

In terms of the location of the team (see Fig.9), around 55% (N=53) of the respondents indicated that the project teams were distributed, while 45% (N=44) indicated that their project teams were co-located.

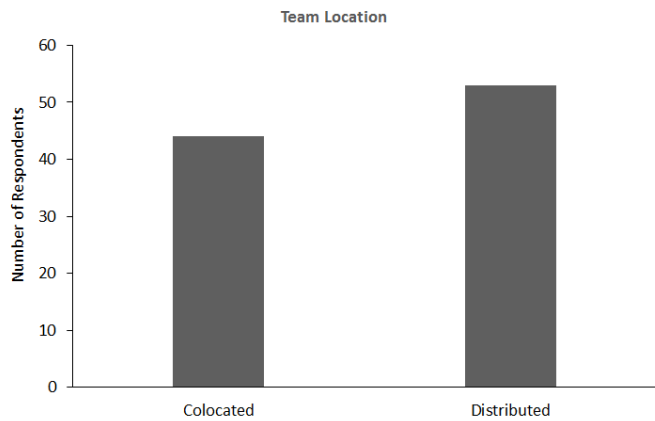


Fig. 9. Co-location vs distribution of team.

For purposes of clarity the agile methods used by the respondents have been classified as: a) Standalone, b) A hybrid of scrum with one other method, and c) A hybrid of scrum with multiple methods. All percentages given in table I-V are absolute percentages from a respondent size of 97.

TABLE I. AGILE METHODS USED BY RESPONDENTS

Agile Method	Usage by Respondents
Standalone	58%
Hybrid	19%
Hybrid of multiple methods	23%

As can be seen from table 1, around 58% of the respondents were using standalone agile methods such as scrum, XP etc. Around 19% were hybrids of scrum with one other method and 23% were hybrids of scrum with multiple methods. All the

percentage values have been rounded up to the nearest whole number.

TABLE II. STANDALONE AGILE METHODS

Agile Method	Usage by Respondents
Scrum	49%
Kanban	2%
Agile SDLC	1%
Feature Driven Development (FDD)	1%
Hybrid Agile/Waterfall	1%
Podio	1%
XP	1%
DSDM	1%
Not Specified	2%

Table II presents a further breakup of the standalone agile methods. The percentages are absolute percentages. The most widely used agile method was scrum, with 49% (N=48) of respondents indicating that their project used scrum. The next popular standalone method was Kanban, with 2% (N=2) respondents. Other methods such as Feature Driven Development (FDD) and eXtreme programming (XP) were used by a minority of the respondents in their current projects.

TABLE III. DUAL HYBRIDS

Agile Method*	Usage by Respondents
Scrum & Kanban	8%
Scrum & FDD	5%
Scrum & Waterfall	3%
Scrum & ASD	1%
Scrum & XP	1%

\*FDD= Feature Driven Development; ASD = Agile Software Development; XP= eXtreme Programming.

Table III shows the breakup of hybrids of scrum with another method (termed dual hybrids). The scrum and kanban combination led the pack with 8% (N=8), closely followed by scrum and FDD with 5% (N=5). Interestingly, 3% (N=3) respondents indicated that scrum was also used in conjunction with waterfall methods.

TABLE IV. MULTIPLE HYBRIDS OF SCRUM

Agile Method	Usage by Respondents
Scrum-Kanban-XP	4%
Scrum-Kanban-Waterfall	4%
Scrum-XP-Waterfall	2%
Scrum-Kanban-XP-FDD-ASD-Waterfall	1%
Scrum-Kanban-FDD	1%

Agile Method	Usage by Respondents
Scrum-Kanban-XP-FDD-Waterfall	1%
Scrum-Kanban-DSDM	1%
Scrum-Kanban-XP-ASD	1%
Scrum-Kanban-XP-SAFe	1%
Scrum-Kanban-FDD-SAFe	1%
Scrum-Waterfall-RUP	1%
Scrum-FDD-Waterfall	1%
Scrum-FDD-Rapid prototyping	1%
Scrum-XP-TDD	1%
Scrum-Waterfall-Chaos	1%

As can be seen from Table IV, the most popular combinations of agile implementations usually included scrum and kanban. These cumulatively accounted for nearly 15% (N=15) of the responses received.

Table V presents a comparison of agile methods reported in our survey with the data reported by the 2016 VersionOne survey [12]. In terms of standalone methods the percentages for scrum usage are very close (49% in this study and 58% in VersionOne). For some methods there was wide variance in percentages as reported by our survey and by VersionOne, e.g. scrum/XP hybrid and multiple hybrids with scrum. One possible reason could be the larger sample size (N=3880) of the VersionOne survey.

TABLE V. COMPARISON WITH VERSIONONE REPORT

Agile Method	Study Results	VersionOne
Scrum	49%	58%
Scrumban (Scrum and Kanban hybrid)	8%	7%
Scrum and FDD hybrid	5%	NMD*
Scrum and Waterfall	3%	NMD
Scrum/XP Hybrid	1%	10%
Scrum and ASD	1%	NMD
Kanban	2%	5%
Feature driven development (FDD)	1%	1%
DSDM	0%	1%
XP	1%	1%
Lean Development	NMD	2%
Iterative development	NMD	3%
Agile Modelling	NMD	1%
Agile Unified Process (AUP)	NMD	<1%
Agile/SDLC	2%	NMD
Hybrid of multiple methods	23%	8%

Agile Method	Study Results	VersionOne
Other	1%	3%
Not specified	1%	2%

\*NMD=No matching data.

### C. Data Analysis

On conducting descriptive statistical analysis of the data it was found that there was a relationship between: a) the presence/absence of the project manager and the size of the team; and b) the presence/absence of the project manager and the team being co-located. The analysis was conducted using SPSS v.23, which is a widely used statistical software.

TABLE VI. CROSS TABULATION OF RELATION BETWEEN TEAM SIZE AND PRESENCE OF PROJECT MANAGER (PM)

Team Size	PM present	PM not present
0-5	8(12.3%)	5(15.6%)
5-10	21(32.3%)	17(53.0%)
10-15	17(26%)	5(15.6%)
15-20	3(4.6%)	1(3.1%)
20-25	3(4.6%)	2(6.3%)
>25	13(20%)	2 (6.3%)
Total	65	32

The results of a cross tabulation analysis between the presence or absence of the project manager and the size of the team are shown in Fig.10 and also in table VI. The percentages are relative to each sub-category. The project manager was present in a majority of respondents (53%) who reported team sizes of 5-10 members. Additionally team sizes of 10-15 members (26%) and over 25 members (20%) also exhibited a higher frequency of the project manager being extant on the project. The team sizes which exhibited a lower existence of the project manager's role were those between 0-5, 15-20 and 20-25. This suggests that in team sizes of between 5-10 members and over 25 members have coordination and management requirements which are fulfilled by the project manager. The ideal team size recommended by practitioner literature is between 3-9 members [27]. However this is the range for which the project manager was present in the majority of cases.

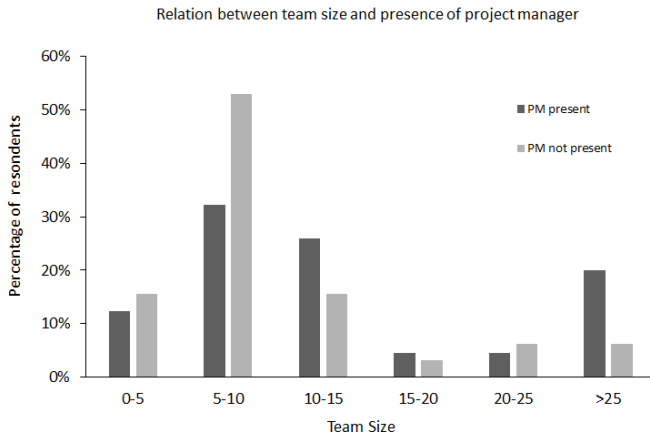


Fig. 10. Cross tabulation analysis of relation between team size and presence of project manager.

Table VII shows the results of a cross tabulation analysis between the presence and absence of the project manager and whether the team is co-located or distributed. The percentages are relative to their sub categories. In co-located projects the project manager was present in only 40% (N=26) of the responses. However, the project manager was present in 60% (N=39) of the distributed projects. This suggests an inverse relationship between the team co-location and the presence of the project manager i.e. there is a higher chance that a co-located team will not have a project manager, while a distributed team has a higher chance of having a project manager.

TABLE VII. CROSS TABULATION OF RELATION BETWEEN TEAM CO-LOCATION/DISTRIBUTION AND PROJECT MANAGER

Team Location	PM is present	PM not present
Colocated	26(40%)	18(56.2%)
Distributed	39(60%)	14(43.6%)
Total	65	32

## V. DISCUSSION AND CONCLUSION

In this paper we have presented the results of an online survey conducted to uncover the frequency of the job title “project manager” in agile software development projects. The survey elicited responses from 97 software practitioners in 31 countries. The main results of the survey are as follows:

- The job title “project manager” was present in nearly 67% of the respondent’s projects.
- It was discovered that there was a strong correlation between the size of the team and the presence of the project manager. There was a higher chance of the project manager being present in a team size of 5-10 members. In team sizes of less than 5 members there was less chance of the project manager being present. This contrasts with published practitioner literature

which specifies the ideal team size of scrum as between 3 to 9 members [26], [27]. Additionally, published practitioner literature clearly specifies that the role of the project manager should not exist in scrum projects [27]. However, in several empirical studies which reported team sizes of between 3 to 10 members, the role of the project manager was very much in existence [32],[33], [34],[35],[36]. One of the reasons for this observation may be that many organizations implement agile methods at the team level while above the team level the traditional project management methodologies are in operation. Empirical studies on team sizes of greater than 20 members have recorded the existence of a project manager [28], [29], [30], [31]. In a study by Martin et al [30] on a team involving 20 members the project manager facilitated the teams functioning by encouraging the involvement of specialists in the project. These findings are supported by the results of this survey as team sizes of over 25 members were found to have the project manager present in the majority of cases. Based on our ongoing research, a possible explanation is that the large teams (>25) are actually aggregations of smaller teams of between 5-7 members. This suggests that large teams have more management and coordination needs and would also explain the presence of the project manager to carry out that task.

- Another interesting result was the relationship between the team co-location (and distribution) and the presence of the project manager. A majority of the distributed teams had a project manager. This finding suggests that coordinating distributed teams in some cases requires a specialized role, which is likely performed by the project manager. Our findings are corroborated by several prior studies where the project manager was found to be managing distributed teams [37], [38], [39], [40] and the role essentially involved coordinating and facilitating their functioning.
- Scrum was by far the most commonly used standalone method (49%). Additionally, scrum was the common denominator in nearly all hybrid methods. This finding compares well with the industry survey where 58% of the respondents used scrum [12].

We set out to answer the question “Does the *project manager* still exist in ASD projects?” The findings of our online survey suggest that the job title of the project manager is still extant in agile projects. We also presented the co-relations between the presence of the project manager and the team size; and between the former and the co-location/distribution of the team. Having established the presence of the project manager title on ASD projects, a number of questions remain unanswered including: why does the project manager exist on ASD projects despite the foundations of ASD doing away with the role? What project management activities are conducted as



part of ASD and what does the role of the project manager entail in ASD projects. Future empirical studies can answer these and other questions to present a better understanding of the role of the project manager in agile projects for theory and practice.

#### ACKNOWLEDGMENT

We would like to thank the participants of the survey. Y.S thanks Shastri family for their support.

#### REFERENCES

- [1] W. W. Royce, "Managing the Development of Large Software Systems: Concepts and Techniques," *Proc. 9th Int. Conf. Software Eng.*, pp. 328-338, 1987.
- [2] H. D. Benington, "Production of large computer programs," *Proc. 9th Int. Conf. Software Eng.*, pp. 299-310, 1987.
- [3] Project Management Institute, *A Guide to the Project Management Body of Knowledge*. Project Manage. Inst., 2013.
- [4] N. Pettersen, "What Do We Know About The Effective Project Manager?" *Int. J. of Project Manage.*, vol. 9, no.2, pp. 99-104, 1991.
- [5] C. Larman and V. R. Basili, "Iterative and Incremental Development: A Brief History," *Computer*, vol. 36, no.6, pp. 47-56, 2003.
- [6] R. Hoda, J. Noble, and S. Marshall, "Self-Organizing Roles on Agile Software Development Teams," *IEEE Trans. on Software Eng.*, vol. 39, no.3, pp. 422-444, 2013.
- [7] K. Schwaber and M. Beedle, *Agile Software Development with Scrum*, Pearson, 2002.
- [8] A. Cockburn and J. Highsmith, "Agile Software Development: The People Factor," *Computer*, vol. 34, no.11, pp. 131-133, 2001.
- [9] J. Stapleton, *DSDM: Business Focussed Development*. Addison-Wesley, 2003.
- [10] R. Palmer and M. Felsing, *A Practical Guide To Feature-Driven Development*. Pearson Education, 2001.
- [11] K. Beck and C. Andres, *Extreme Programming Explained: Embrace Change*. Addison-Wesley, 2005.
- [12] 10th Annual State of Agile Survey. *Version one., 2016*. [Online] Available: <https://versionone.com/pdf/VersionOne-10th-Annual-State-of-Agile-Report.pdf>. Accessed on: June 20, 2016.
- [13] T. Dybå and T. Dingsøy, "Empirical Studies of Agile Software Development: A Systematic Review," *Inform. and Software Technology*, vol. 50, no.9-10, pp. 833-859, 2008.
- [14] P. Abrahamsson, J. Warsta, M. T. Siponen, and J. Ronkainen, "New Directions on Agile Methods: A Comparative Analysis," *Proc. of the 25th Int. Conf. on Software Eng.*, pp. 244-254, 2003.
- [15] P. Fitsilis, "Comparing PMBOK and Agile Project Management Software Development Processes," in *Advances in Comput. and Inform. Sciences and Eng.*, Springer Netherlands, pp. 378-383, 2008.
- [16] J. A. Highsmith, *Agile Project Management: Creating Innovative Products*. Addison-Wesley, 2004.
- [17] R. Hoda and L. Murugesan, "Multi-Level Agile Project Management Challenges: A Self-Organizing Team Perspective", *Journal of Systems and Software*, vol. 117, pp. 245-257, 2016.
- [18] P. O. Gaddis, "The Project Manager," *Harvard Bus. Review*, vol. 37, no.3, pp. 89-97, 1959.
- [19] S. Cicmil, T. Williams, J. Thomas, and D. Hodgson, "Rethinking Project Management: Researching the Actuality of Projects," *Int. J. of Project Manag.*, vol. 24, no.8, pp. 675-686, 2006.
- [20] N. B. Ruparelia, "Software development lifecycle models," *ACM SIGSOFT Software Eng. Notes*, vol. 35, no.3, pp. 8-13, 2010.
- [21] S. Augustine, *Managing Agile Projects*. Prentice Hall, PTR, 2005.
- [22] H. D. Benington, "Production of large computer programs," *Proc. 9th Int. Conf. Software Eng.*, pp. 299-310, 1987.
- [23] S. Nerur, R. Mahapatra, and G. Mangalaraj, "Challenges of Migrating to Agile Methodologies," *Commun. of the ACM*, vol. 48, no.5, pp. 72-78, 2005.
- [24] M. L. Drury-Grogan and O. O'dwyer, "An Investigation of the Decision-Making Process in Agile Teams," *Int. J. of Inform. Technology & Decision Making*, vol. 12, no.6, pp. 1097-1120, 2013.
- [25] J. Highsmith and M. Fowler, "The Agile Manifesto," *Software Development Magazine* 9, vol. 8, pp. 29-30, 2001.
- [26] P. Deemer, G. Benefield, B. Vodde, C. Larman, "The Scrum Primer: A lightweight guide to the theory and practice of Scrum", Version 2.0, 2012. [Online]. Available: <http://www.scrumprimer.org/>
- [27] J. Sutherland and K. Schwaber, "The Scrum Guide, The Definitive Guide to Scrum: The Rules of the Game", 2016. [Online]. Available at : <http://www.scrumguides.org/docs/scrumguide/v2016/2016-Scrum-Guide-US.pdf#zoom=100>
- [28] N. N. Tuan and H. Q. Thang, "Combining Maturity with Agility: Lessons Learnt from a Case Study," *Proc. of the 4th Symp. on Inform. and Commun. Technology*, pp. 267-274, 2013.
- [29] H. Robinson and H. Sharp, "Collaboration, Communication and Co-ordination in Agile Software Development Practice," in *Collaborative Software Eng.*, pp. 93-108, 2010.
- [30] A. Martin, R. Biddle, and J. Noble, "An Ideal Customer: A Grounded Theory of Requirements Elicitation, Communication and Acceptance on Agile Projects," *Agile Software Develop.*, pp. 111-141, 2010.
- [31] H. Sharp and H. Robinson, "Three 'C's' of Agile Practice: Collaboration, Co-ordination and Communication," *Agile Software Develop.*, pp. 61-85, 2010.
- [32] V. Gulliksen Stray, N. Brede Moe, and T. Dingsøy, "Challenges to Teamwork: A Multiple Case Study of Two Agile Teams," *Agile Processes in Software Eng. and Extreme Programming*, vol. 77, pp. 146-161, 2011.
- [33] M. de Azevedo Santos, P. Henrique de Souza Bermejo, A. Olimpio Tonelli, and A. Luiz Zambalde, "Challenges of Teams Management: Using Agile Methods to Solve the Common Problems," *ENTERprise Inform. Systems*, vol. 220, pp. 297-305, 2011.
- [34] J. McAvoy and T. Butler, "The Role of Project Management in Ineffective Decision Making Within Agile Software Development Projects," *European J. of Inform. Syst.*, vol. 18, no.4, pp. 372-383, 2009.
- [35] M. Pikkarainen, O. Salo, R. Kuusela, and P. Abrahamsson, "Strengths and Barriers Behind the Successful Agile Deployment-Insights from the Three Software Intensive Companies in Finland," *Empirical Software Eng.*, vol. 17, no.6, pp. 675-702, 2012.
- [36] Q. Pham, A. Nguyen, and S. Misra, "Apply Agile Method for Improving the Efficiency of Software Development Project at VNG Company," *Lecture Notes in Comput. Sci.*, vol. 7972, pp. 427-442, 2013.
- [37] E. Hossain, M. A. Babar, and J. Verner, "How can Agile Practices Minimize Global Software Development Co-Ordination Risks?," *Commun. in Comput. and Inform. Sci.*, vol. 42, pp. 81-92, 2009.
- [38] J. M. Robarts, "Practical Considerations for Distributed Agile Projects," *Proc. Agile2008 Conf.*, pp. 327-332, 2008.
- [39] D. Badampudi, S. A. Fricker, and A. M. Moreno, "Perspectives on Productivity and Delays in Large-Scale Agile Projects," *Agile Processes in Software Eng. and Extreme Programming*, vol. 149, pp. 180-194, 2013.
- [40] J. van Hillegersberg, G. Ligtenberg, and M. N. Aydin, "Getting Agile Methods to Work for Cordys Global Software Product Development," in *New Studies in Global IT and Business Service Outsourcing*, vol. 91, pp. 133-152, 2011.